Yield response to copper, zinc and boron fertilizers in contrasting prairie soils

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Justification

- Micronutrient elements required in smaller amount but essential for plant growth
- The range between deficiency and toxicity can be very narrow
- Best approach depends on crop, soil and agronomic factors

(Alloway, 2008)

Justification

Micronutrient deficiency issues in prairies:

- ***Site specific:*** a patchy distribution associated with field scale variability of soil properties
- ***Crop and element specific:*** Cu deficiency for cereal crops, Zn for pulse crops like pea, while B applications may be beneficial for canola

Justification

- Inconsistent yield response to fertilization reported
  - *Uncertainty about soil test critical levels*
- Soil and environmental properties along with fertilizer form and application method can control fate and efficacy
  - *Transformation and complexation*
  - *Redistribution to unavailable pools*

Liang et al., 1990,91; Karamanos and Goh, 2001; Karamanos et al. 2003a,b

Objective

To evaluate the impact of micronutrient fertilization on yield of crops grown in contrasting prairie soils under polyhouse conditions

Parameters evaluated include micronutrient fertilizer form, application method and effect of crop rotation

Methods and Materials

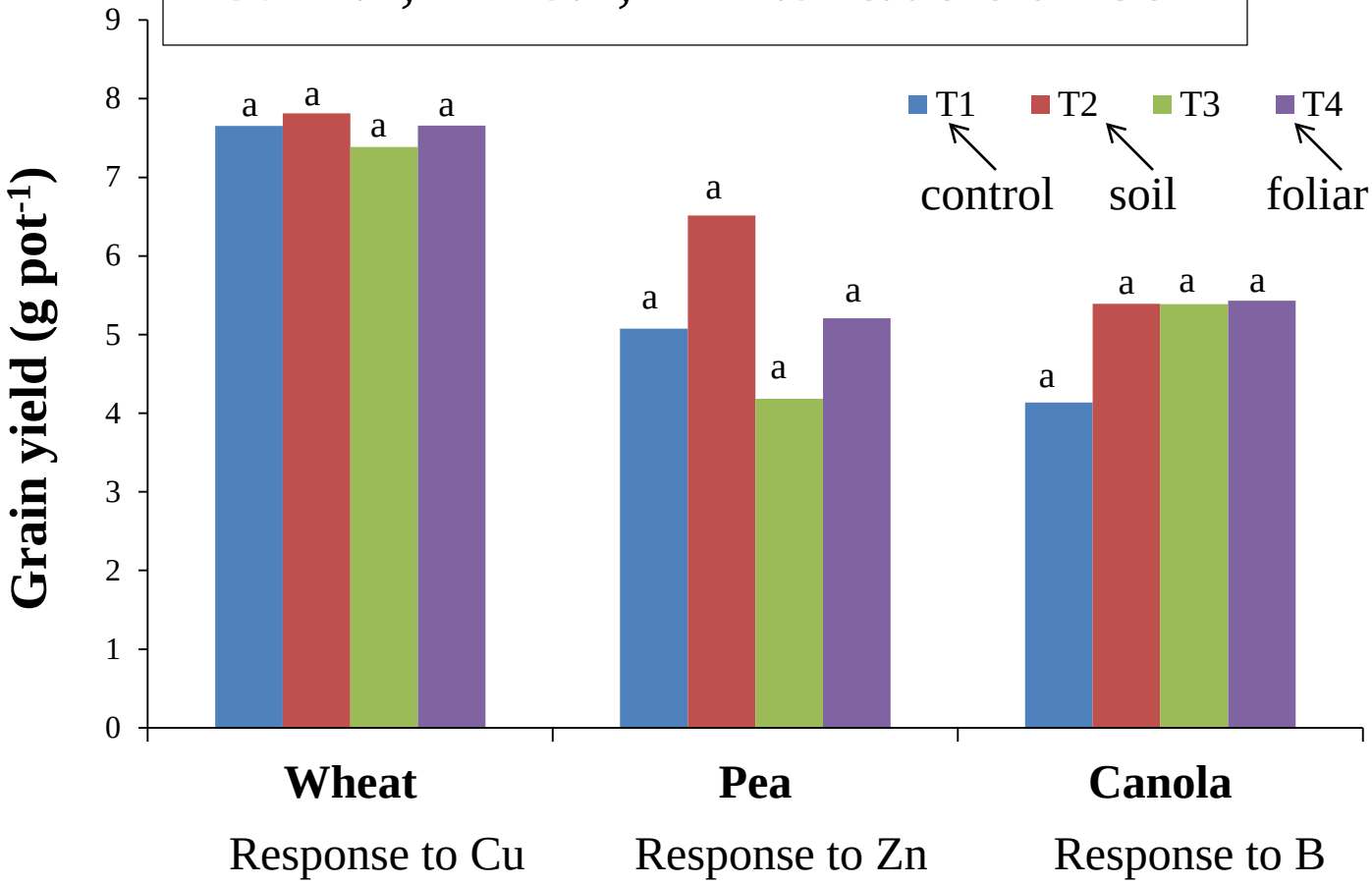
Treatments		
Wheat (Cu)	***Pea (Zn)***	***Canola (B)***
T_1: Control	T_1: Control	T_1: Control
T_2: soil application @ 5 kg Cu ha^{-1} ($CuSO_4.5H_2O$)	T_2: soil application @ 2 kg Zn ha^{-1} ($ZnSO_4.7H_2O$)	T_2: soil application @ 1 kg B ha^{-1} (boric acid)
T_3: soil application @ 2 kg Cu ha^{-1} (chelated product)	T_3: soil application @ 1 kg Zn ha^{-1} (chelated product)	T_3: foliar application @ 0.25 kg B ha^{-1} (one time)
T_4: foliar application @ 0.25 kg Cu ha^{-1} (chelated product)	T_4: foliar application @ 0.25 kg Zn ha^{-1} (chelated product)	T_4: foliar application @ 0.25 kg B ha^{-1} (two times) using boric acid

Whitewood Dark Gray Chernozem (Danbury)
Echo Brown Solodized Solonetz (Central Butte)
Whitefox Dark Gray Chernozem (Nipawin)
Sceptre Orthic Vertisol (Sceptre)
Ukalta Black Chernozem (Alix, AB)

All soils received basal application of N, P, K and S

Results

WHITEWOOD O.DGC (Danbury, SK)
Cu=1.7; Zn=3.2; B= 1.9 lb/acre 0-15cm



WHITEWOOD O.DGC (Danbury, SK)

Cu=1.7; Zn=3.2; B= 1.9 lb/acre

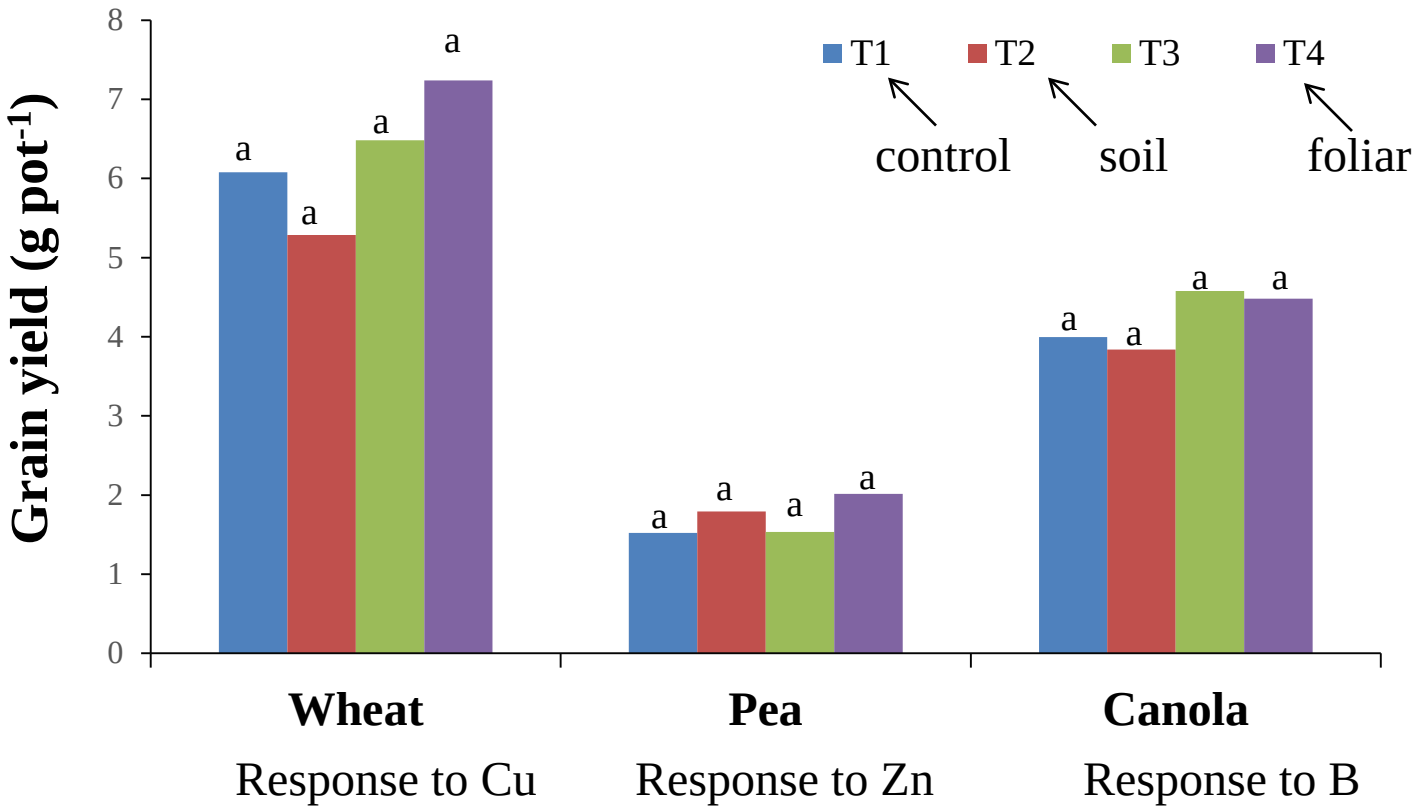
T1 T2 T3 T4

T1 T2 T3 T4

T1 T2 T3 T4

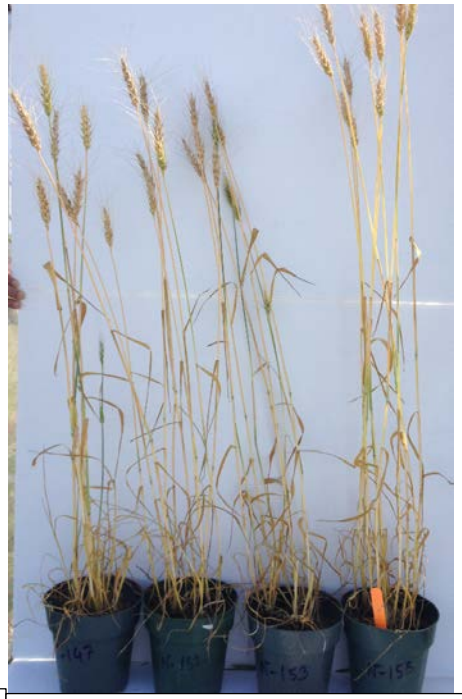
T1 T2 T3 T4

ECHO B.SS (Central Butte, SK): *Cu=1.4*; Zn=2.6; B= 2.1 lb/acre



ECHO B.SS (Central Butte, SK):
Cu=1.4; Zn=2.6; B= 2.1 lb/acre

T1 T2 T3 T4



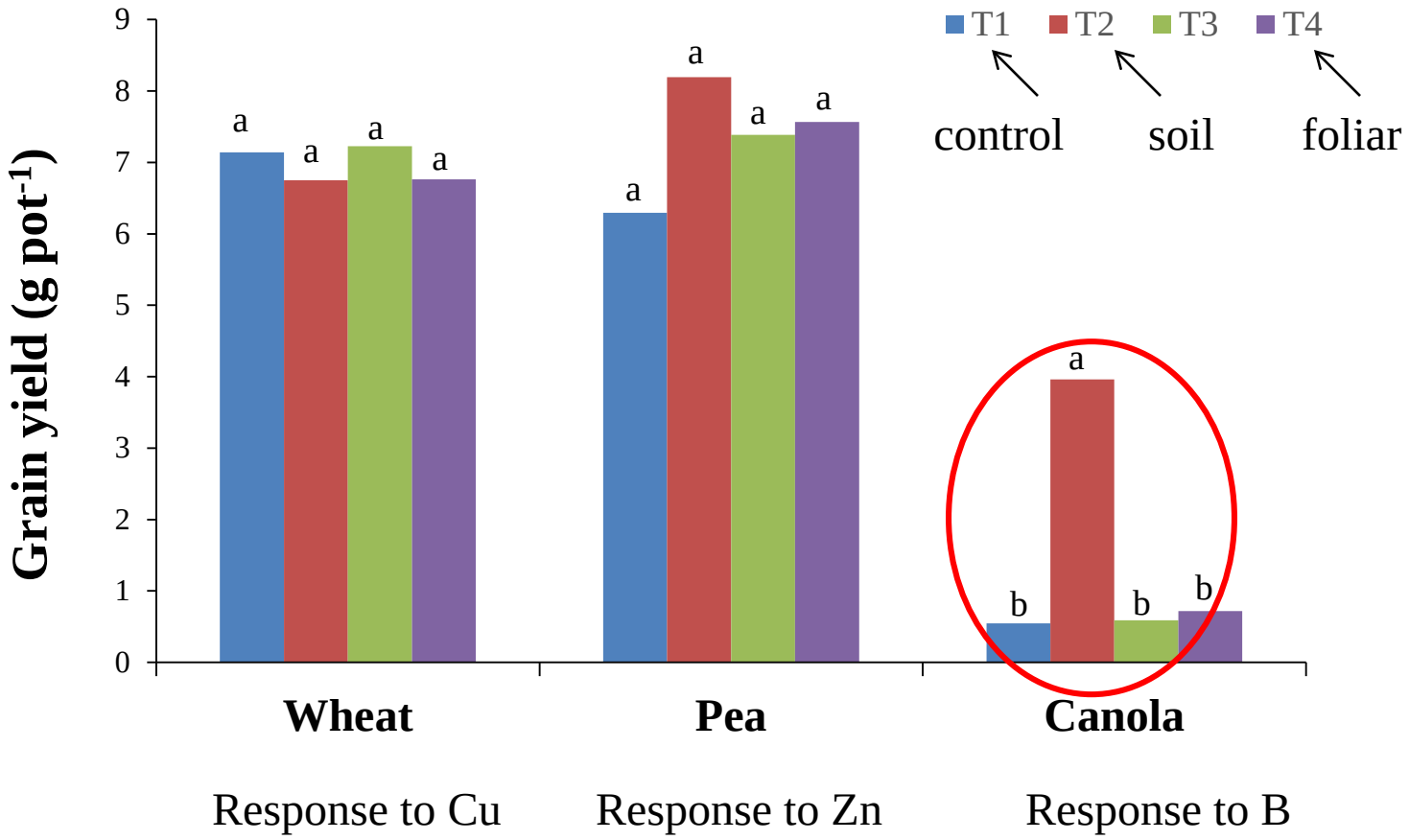
T1 T2 T3 T4

T1 T2 T3 T4

T1 T2 T3 T4

WHITEFOX O.DGC (Nipawin, SK)

Cu=2.6; Zn=3.5; ***B=1.1*** lb/acre



WHITEFOX O.DGC (Nipawin, SK)

Cu=2.6; Zn=3.5; ***B=1.1*** lb/acre

T1 T2 T3 T4

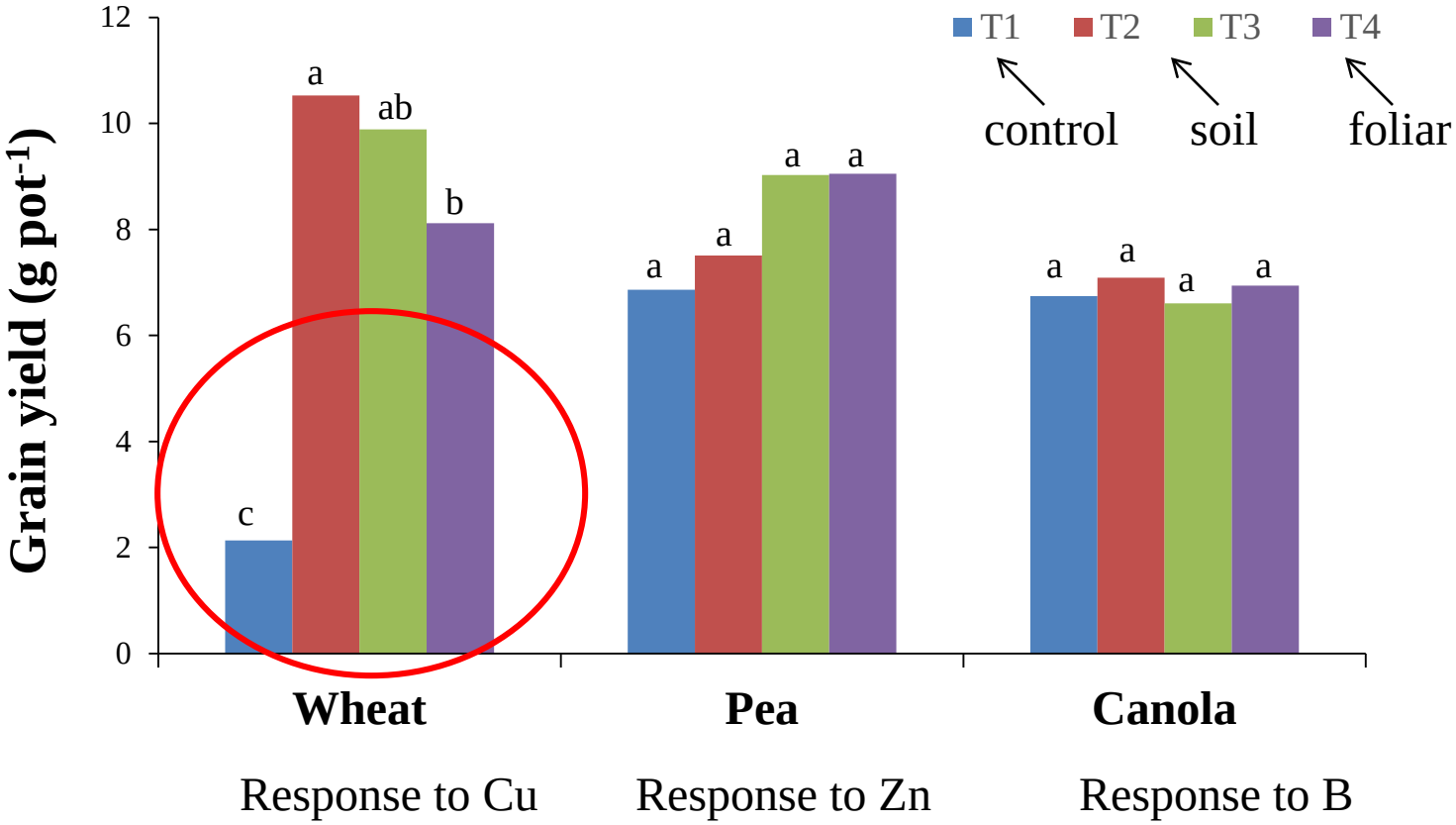
T1 T2 T3 T4

T1 T2 T3 T4

T1 T2 T3 T4

UKALTA series (Alix, AB)

Cu=0.9; Zn=5.3; B= 1.9 lb/acre



Ukalta series (Alix, AB)

Cu=0.9; Zn=5.3; B= 1.9 lb/acre

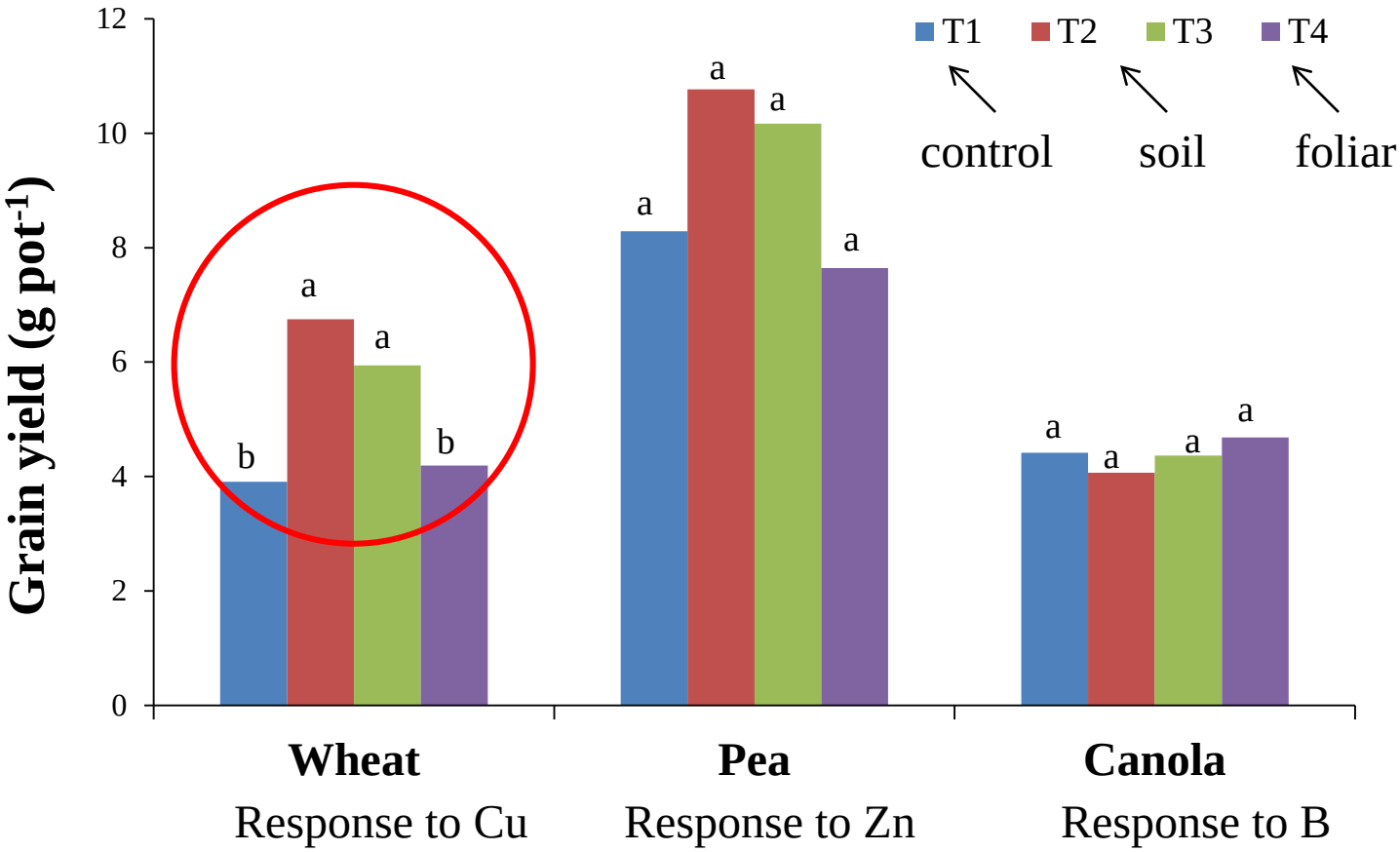
T1 T2 T3 T4

T1 T2 T3 T4

T1 T2 T3 T4

T1 T2 T3 T4

SCEPTRE O.V (Sceptre, SK)
Cu=3.2; ***Zn=1.5***; B= 2.3 lb/acre



SCEPTRE O.V (Sceptre, SK)

Cu=3.2; ***Zn=1.5***; B= 2.3 lb/acre

T1 T2 T3 T4

T1 T2 T3 T4

T1 T2 T3 T4

T1 T2 T3 T4

Summary

- Wheat grown on two of the five soils responded significantly to Cu fertilization.
  - -one soil was below critical level (Ukalta), one not (Sceptre).
  - - soil applied Cu effective on both, foliar only one.

- No significant response of peas to Zn fertilization on any of the five soils.
  - - four of five soils above critical level, one soil marginal.
  - - agrees with Anderson (2015) for Zn on lentil.

- Canola responded to B on one soil (Whitefox).
  - - soil was below critical limit
  - - only soil application was effective.

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Thank you

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